

CURRICULUM VITAE

CHRISTIAN FRANKENBERG

Contact Information	Jet Propulsion Laboratory California Institute of Technology 4800 Oak Grove Drive, MS 183-630 Pasadena, California 91109-8099 USA	: +1-818-354-1087 : +1-626-375-1917 : cfranken@jpl.nasa.gov
Research Interests	Remote sensing of atmospheric trace gases, biogeochemical cycles, hydrological cycle and distribution of water isotopes, inverse methods, applied spectroscopy	
Education	Ruprecht-Karls-University , Heidelberg, Germany	
	Dr. rer. nat., summa cum laude, Institute of Environmental Physics	Nov. 2005
	<ul style="list-style-type: none">• Thesis: "Retrieval of methane and carbon monoxide using near infrared spectra recorded by SCIAMACHY onboard ENVISAT - Algorithm development and data analysis"• Advisor: Prof. Ulrich Platt and Prof. Jos Lelieveld	
	University of Bayreuth , Bayreuth, Germany	
	Diplom in Geoecology, with honors	May 2002
	<ul style="list-style-type: none">• Thesis: "Evaluating Stationarity in Ecological Timeseries"• Advisor: Dr. habil. Holger Lange and Prof. Otto Klemm• Focus: Atmospheric chemistry, ecological modeling, micrometeorology, physical chemistry, numerical mathematics	
	Additional qualification in multimedia competence	2000-2002
	<ul style="list-style-type: none">• Basic and advanced courses in programming and informatics	
	Vordiplom in Geoecology, with honors	Nov. 1999
Short courses	Spring School in Quant. Earth Obs. Data, Oxford, UK Summer School, Environmental Physics, Heidelberg, Germany	Mar. 2003 Jul. 2001
Grants and awards	Dutch Science Foundation, Innovational Research Incentives Scheme Veni: Research grant (208k€) Best presentation award, SRON Science Days, German chemistry society, best chemistry graduate at Ernst-Kalkuhl-Gymnasium Bonn,	Sep. 2006 - Sep. 2009 2008 1996
Academic Experience	Jet Propulsion Laboratory - California Institute of Technology , Pasadena, USA	
	Scientist	Jan. 2010 - present
	<ul style="list-style-type: none">• Greenhouse Gas Retrievals from the Japanese GOSAT satellite.• Instrument concept development for future Greenhouse-Gas missions.	
	Netherlands Institute for Space Research , Utrecht, The Netherlands	
	VENI Postdoctoral Researcher	Sep. 2006 - Dec. 2009
	<ul style="list-style-type: none">• Retrieval of atmospheric methane using near-infrared space-borne spectrometers.• Simultaneous retrievals of atmospheric H₂O, HDO and CO.	

- Laboratory studies of spectroscopic parameters, impact of spectroscopic uncertainties on trace gas retrievals.
- Co-supervision of a PhD student at the University of Heidelberg, Germany.
- Organiser and leader of group meetings in the Earth Observation Division.
- Responsible for public outreach using GoogleEarth visualisation.

Institute of Environmental Physics, Heidelberg, Germany

Postdoctoral Researcher

Nov. 2005 – Aug. 2006

- Retrieval of atmospheric methane and carbon monoxide using near-infrared space-borne spectrometers.
- Co-supervision of a graduate student.
- Responsible for software development and hardware maintenance of the Satellite Group.

Publications

H. Tran, J.-M. Hartmann, G. Toon, L.R. Brown, **C. Frankenberg**, T. Warneke, P. Spietz and F. Hase: The $2\nu_3$ band of CH₄ revisited with line mixing: Consequences for spectroscopy and atmospheric retrievals at 1.67 μm , *Journal of Quantitative Spectroscopy and Radiative Transfer* Volume 111, Issue 10, July 2010, Pages 1344-1356 (2010).

A. Bloom, P. I. Palmer, A. Fraser, D. Reay, **C. Frankenberg**: Large-scale Observations of Methanogenesis Inferred From Satellite Observations of Methane and Gravity, *Science*, 327, 322 (2009).

F. Keppler, M. Boros, **C. Frankenberg**, J. Lelieveld, A. McLeod, A.M. Pirtilae, T. Roeckmann, and J.P. Schnitzler: Methane formation in aerobic environments, *Environmental Chemistry*, 6, 459–65 (2009).

P. Bergamaschi, **C. Frankenberg**, J.F. Meirink, M. Krol, M.G. Villani, S. Houweling, F. Dentener, E.J. Dlugokencky, J.B. Miller, A. Engel, and I. Levin: Inverse modeling of global and regional CH₄ emissions using SCIAMACHY satellite retrievals, *J. Geophys. Res.*, 114, D22301, (2009)

Schrijver, H. and Gloudemans, A.M.S. and **Frankenberg**, C. and Aben, I., Water vapour total columns from SCIAMACHY spectra in the 2.36 m window, *Atmos. Meas. Tech.*, 2, 561–571 (2009).

Frankenberg, C., K. Yoshimura, T. Warneke, , I. Aben, A. Butz, N. Deutscher, D. Grith, F. Hase, J. Notholt, M. Schneider, H. Schrijver, and T. Roeckmann, Dynamic Processes Governing Lower-Tropospheric HDO/H₂O Ratios as Observed from Space and Ground. *Science*, 325 (5946), 1374 (2009).

Butz, A., O. P. Hasekamp, **C. Frankenberg**, and I. Aben (2009), Retrievals of atmospheric CO₂ from simulated space-borne measurements of backscattered near-infrared sunlight: accounting for aerosol effects, *Appl. Opt.* 48, 3322-3336, DOI:10.1364/AO.48.003322.

Frankenberg, C., P. Bergamaschi, A. Butz, S. Houweling, J. F. Meirink, K. Petersen, H. Schrijver, T. Warneke, and I. Aben (2008), Tropical methane emissions: A revised view from SCIAMACHY onboard enisat, *Geophys. Res. Lett.*, 35, L15811, DOI:10.1029/ 2008GL034300. ☉

Meirink, J. F., P. Bergamaschi, **C. Frankenberg**, M. T. S. d'Amelio, E. J. Dlugokencky, L. V. Gatti, S. Houweling, J. B. Miller, T. Röckmann, M. G. Villani, and M. Krol (2007), Four-dimensional variational data assimilation for inverse modelling of atmospheric methane emissions: Analysis of SCIAMACHY observations, *J. Geophys. Res.*, DOI:10.1029/2007JD009740, in press.

Wagner, T., S. Beirle, T. Deutschmann, E. Eigemeier, **C. Frankenberg**, M. Grzegorski, C. Liu, T. Marbach, U. Platt, M. Penning de Vries (2008), Monitoring of atmospheric trace gases, clouds, aerosols and surface properties from UV/vis/NIR satellite instruments, *J. Opt. A: Pure Appl. Opt.* 10 DOI: 10.1088/1464-4258/10/10/104019

Frankenberg, C., T. Warneke, A. Butz, L. R. Brown, F. Hase, P. Spietz, and I. Aben (2008), Methane spectroscopy in the near infrared and its implication on atmospheric retrievals, *Atm. Chem. Phys.*, 8, 5061–5075. ☉

Houweling, S., T. Röckmann, I. Aben, F. Keppler, M. Krol, J. Meirink, E. Dlugokencky, and **C. Frankenberg** (2006), Atmospheric constraints on global emissions of methane from plants,

Geophys. Res. Lett., 33, L15,821, DOI:10.1029/2006GL026162. 

Bergamaschi, P., **C. Frankenberg**, J. F. Meirink, M. Krol, F. Dentener, T. Wagner, U. Platt, J. Kaplan, S. Körner, M. Heimann, et al. (2007), Satellite chartography of atmospheric methane from SCIAMACHY on board ENVISAT: 2. Evaluation based on inverse model simulations, *J. Geophys. Res.*, 112(D2), D02,304, DOI:10.1029/ 2006JD007268. 

Frankenberg, C., J. Meirink, P. Bergamaschi, A. Goede, M. Heimann, S. Körner, U. Platt, M. van Weele, and T. Wagner (2005), Satellite chartography of atmospheric methane from SCIAMACHY onboard ENVISAT: Analysis of the years 2003 and 2004, *J. Geophys. Res.*, 111, DOI:10.1029/ 2005JD006235. 

Dils, B., M. De Maziere, J. Muller, T. Blumenstock, M. Buchwitz, R. de Beek, P. Demoulin, P. Duchatelet, H. Fast, **C. Frankenberg**, et al. (2006), Comparisons between SCIAMACHY and ground-based FTIR data for total columns of CO, CH₄, CO₂ and N₂O, *Atmos. Chem. Phys.*, 6(7), 1953–1976. 

Frankenberg, C., J. F. Meirink, M. van Weele, U. Platt, and T. Wagner (2005), Assessing Methane Emissions from Global Space-Borne Observations, *Science*, 308(5724), 1010–1014, DOI:10.1126/science.1106644. 

Frankenberg, C., U. Platt, and T. Wagner (2005), Retrieval of CO from SCIAMACHY onboard ENVISAT: detection of strongly polluted areas and seasonal patterns in global CO abundances, *Atmos. Chem. Phys.*, 5, 1639–1644. 

Khokhar, M., **C. Frankenberg**, M. Van Roozendael, S. Beirle, S. Kühl, A. Richter, U. Platt, and T. Wagner (2005), Satellite observations of atmospheric SO₂ from volcanic eruptions during the time-period of 1996–2002, *Adv. Space Res.*, 36(5), 879–887.

Frankenberg, C., U. Platt, and T. Wagner (2005), Iterative maximum a posteriori (IMAP)-DOAS for retrieval of strongly absorbing trace gases: Model studies for CH₄ and CO₂ retrieval from near infrared spectra of SCIAMACHY onboard ENVISAT, *Atmos. Chem. Phys.*, 5, 9–22. 

Kühl, S., W. Wilms-Grabe, S. Beirle, **C. Frankenberg**, M. Grzegorski, J. Hollwedel, F. Khokhar, S. Kraus, U. Platt, S. Sanghavi, C. von Friedeburg, and T. Wagner (2004), Stratospheric chlorine activation in the Arctic winters 1995–200102 derived from GOME OCIO measurements, *Adv. Space Res.*, 34, 798–803, DOI:10.1016/j.asr.2003.08.069.

Conference Publications

Frankenberg, C., Gloudemans, A., Meirink, J.F., Wagner, T., Houweling, S., Bergamaschi, P., Aben, I., Schrijver, H. (2007), Satellite Chartography of Atmospheric Methane from SCIAMACHY onboard ENVISAT, in *Proceedings. ENVISAT symposium, Montreux (CH), 23-27 Apr 2007. (European Space Agency, Paris, 2007) (ESA-SP-636)*

Gloudemans, A. M. S., H. Schrijver, A. G. Straume, I. Aben, A. N. Maurellis, M. Buchwitz, R. de Beek, **C. Frankenberg**, T. Wagner, and J. F. Meirink (2004), CH₄ and CO Total Columns from SCIAMACHY: Comparisons With TM3 and MOPITT, in *ESA SP-562: Atmospheric Chemistry Validation of ENVISAT (ACVE-2)*.

Frankenberg, C., Platt, U. and Wagner, T. (2004), Retrieval of CO from SCIAMACHY onboard ENVISAT, in *Proceedings of the ENVISAT & ERS Symposium, 6-10 September 2004, Salzburg, Austria, ESA publication SP-572, (CD-ROM)*.

Grzegorski, M., **C. Frankenberg**, U. Platt, M. Wenig, N. Fournier, P. Stammes, and T. Wagner (2004), Determination of cloud parameters from SCIAMACHY data for the correction of tropospheric trace gases, in *Proceedings of the ENVISAT & ERS Symposium, 6-10 September 2004, Salzburg, Austria, ESA publication SP-572, (CD-ROM)*.

Khokhar, M. F., **C. Frankenberg**, J. Hollwedel, S. Beirle, S. Khl, M. Grzegorski, W. Wilms-Grabe,

U. Platt, and T. Wagner (2004), Satellite remote sensing of atmospheric SO₂: Volcanic eruptions and anthropogenic emissions, in *Proceedings of the ENVISAT & ERS Symposium, 6-10 September 2004, Salzburg, Austria, ESA publication SP-572, (CD-ROM)*.

Kühl, S., W. Wilms-Grabe, **C. Frankenberg**, S. Kraus, U. Platt, and T. Wagner (2004), First results on the DOAS retrieval of OCIO from SCIAMACHY nadir measurements, in *Proceedings of the ENVISAT & ERS Symposium, 6-10 September 2004, Salzburg, Austria, ESA publication SP-572, (CD-ROM)*.

Bramstedt K., M. Buchwitz, U. Blum, T. Blumenstock, **C. Frankenberg**, P. von der Gathen, R. Koelemeijer, M. de Mazière, A. Richter, C. von Savigny, H. Schrijver, A. Schulz, W. Steinbrecht (2003), Comparison of scientific SCIAMACHY products with ground-based measurements, in *Proceedings of the Envisat Validation Workshop (SP-531), ESA Publications Division on CD, 2003*.

Wilms-Grabe, W., Wagner, T., Kühl, S., Beirle, S., Frankenberg, C., Grzegorski, M., Hollwedel, J., Khokhar, F., Kraus, S., Sanghavi, S. and others (2002), Monitoring of stratospheric chlorine activation with GOME OCIO measurements, in *Proceedings on the Sixth European Workshop on Polar Stratospheric Ozone, Gothenborg*.

Invited talks	EGU general assembly, Vienna, Austria Water Isotope workshop, Paris, France Anaerobic methane workshop, Mainz, Germany AGU fall meeting, San Francisco, USA Institute of Environmental Physics, University of Bremen, Germany Institute for Meteorology and Climate Research, Karlsruhe, Germany	May 2010 April 2010 2009 Dec. 2008 May 2008 May 2007
Scientific Presentations	Only selected oral presentations at conferences are listed AGU fall meeting, San Francisco, USA ENVISAT symposium, Montreux, Switzerland Atmospheric Science Conference, ESA ESRIN Frascati, Italy Deutsche Physikalische Gesellschaft, Heidelberg, Germany AGU fall meeting, San Francisco, USA European Physical Society, Bern, Switzerland IWGGMS workshop, Pasadena, USA Deutsche Physikalische Gesellschaft, Berlin, Germany ENVISAT Symposium, Salzburg, Austria EGS spring meeting, Nice, France DOAS Workshop, Heidelberg, Germany	Dec. 2007 Apr. 2007 May 2006 Mar. 2006 Dec. 2005 Jul. 2005 Mar. 2005 Mar. 2005 Sep. 2004 Apr. 2004 Sep. 2003
Public Presentations	Press event “Exploring Environmental Change: SCIAMACHY - Six years in space” Oral presentation: “SCIAMACHY and Climate Change”	May 2008
Projects	Projects in which I participate(d) GOSAT, Greenhouse gases Observing SATellite by the Japan Aerospace Exploartion Agency (JAXA), PI of a GOSAT Research Announcement  	
Technical Skills	Extensive experience in scientific computing using Matlab and, for larger projects, object oriented C++. Experience in storage hardware (RAID systems) and relational database systems (MySQL, Postgres). Standard scientific software packages: Matlab, IDL Programming: C++, Gnu Scientific Library, Python, Java, PHP, UNIX shell scripting, SQL, SVN Operating Systems: Linux, MacOS X, Microsoft Windows	
Other activities	Development, implementation and maintenance (as team with 2 co-students) of an automated web-based evaluation system of lectures given at the faculty of Biology, Chemistry and Geosciences at Bayreuth University. Self-initiated and voluntary project using Java Servlets, MySQL and L ^A T _E X. Features: Automatic generation of online evaluation forms, password protection, statistical analysis and pdf export of a statistical summary. Till date used for about 100 lectures a year. 2000-2002	

Network assistant, Bayreuth University, Computer center 1999-2001

Paramedic education June-July 1997

Memberships American Geophysical Union, European Geophysical Union, American Association for the Advancement of Science, German Physical Society

Reviewer Atmospheric Chemistry and Physics
Journal of Geophysical Research
Remote Sensing of the Environment

References

Prof. Dr. Ulrich Platt
 Institute of Environmental Physics
 Heidelberg University, Germany
 Im Neuenheimer Feld 229
 D-69120 Heidelberg / Germany
 ☎: + 49 6221 54-6339
 fax: + 49 6221 54-6405
 e-mail : ulrich.platt@iup.uni-heidelberg.de

Prof. Dr. Ilse Aben
 Netherlands Institute for Space Research
 Free University of Amsterdam
 Sorbonnelaan 2
 3584 CA Utrecht / The Netherlands
 ☎: +31 (0) 30-2538579
 fax: +31 (0) 30-2540860
 e-mail : E.A.A.Aben@sron.nl

Prof. Dr. Jos Lelieveld
 Director
 Max-Planck-Institute for Chemistry
 Department of Atmospheric Chemistry
 J.J. Becherweg 27
 D-55128 Mainz / Germany
 ☎: +49 - (0) 6131 - 305-458
 fax: +49 - (0) 6131 - 305-511
 e-mail : lelieveld@mpch-mainz.mpg.de

Prof. Dr. Thomas Röckmann
 Institute for Marine and Atmospheric research Utrecht
 Atmospheric Physics and Chemistry Group
 Princetonplein 5, 3584 CC Utrecht
 PO box 80000, 3508 TA Utrecht
 The Netherlands
 ☎: +31 30 253 3858
 fax: +31 30 254 3163
 e-mail : t.roeckmann@uu.nl

Charles Miller, Deputy Principal Investigator
 Orbiting Carbon Observatory Project
 and Climate, Oceans and Solid Earth Science
 MS 183-501, Jet Propulsion Laboratory
 4800 Oak Grove Drive
 Pasadena CA 91109-8099 USA
 ☎: +1 818 393 6294
 fax: +1 818 653 3014
 fax: +1 818 354 0966
 e-mail : charles.e.miller@jpl.nasa.gov